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RJ Grimshaw

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WATER SUPPLY

FOR CITIES AND TOWNS,

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JW

AND DESCRIPTION OF AN

IMPROVED FIRE PROTECTION.

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HENRY P. M. BIRKINBINE,

HYDRAULIC ENGINEER,

May be consulted upon all matters relating to the Water Supply of Cities and Towns; Construction of Sewage Works; Drainage of Marsh Lands; Value of Water Powers, etc. Expert Testimony prepared and valuations for purchase made in Water Right, Navigation or Riparian suits. Examinations, Investigations and Surveys made. Estimates, Bills of quantities, Specifications, Plans and Detailed Drawings prepared for Reservoirs, Dams, Aqueducts, Pumping Machinery, etc., etc., etc.

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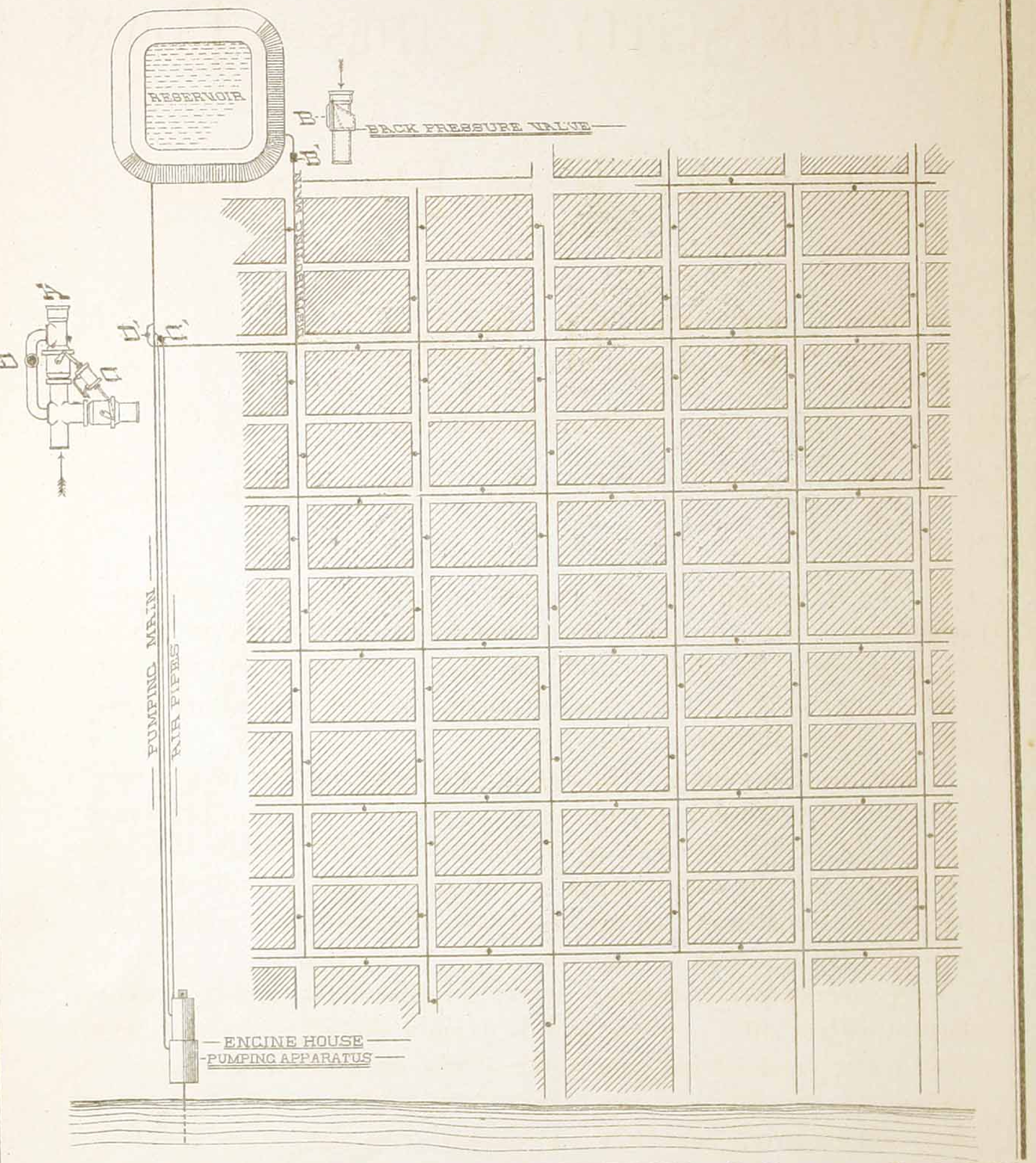

IMPROVED FIRE PROTECTION

H.P.M.BIRKINBINE

ENGINEER

152 Sth FOURTH St PHILADELPHIA

A, Reversing Apparatus
B, Back Pressure Valve
C, Operating Cylinder
→•, Fire Hydrants
D, Safety Valve

Patented { Dec. 31st 1872
Jany 11th 1876

Photo-Lith. by J. CARBUTT, 624 N. 24th St., Phila.

WATER SUPPLY FOR CITIES AND TOWNS,

—AND—

IMPROVED FIRE PROTECTION,

—BY—

H. P. M. BIRKINBINE,

HYDRAULIC ENGINEER,

No. 152 SOUTH FOURTH STREET, PHILADA.

There are few, if any, cities or towns, or even villages of importance, whose inhabitants do not recognize the desirability, and in most cases the indispensability of an ABUNDANT PUBLIC WATER SUPPLY, not only for domestic purposes, but also for sanitary reasons and for protection from fire.

Owing to a generally mistaken idea as to the cost of a properly constructed water supply, and the economy of such an improvement, as well as the failure of many of the works built within late years to fulfill the promises made for them, a number of our most progressive communities are deprived of advantages which otherwise they would now be enjoying.

A properly constructed water supply is seldom a financial burden to any city or town, and it is only exceptional cases, where after a few years of use, the water works are not self-sustaining and a means of revenue. IF THE SYSTEM OF SUPPLY EMBRACES A COMPLETE FIRE PROTECTION, PROPERLY ARRANGED, THE SAVING IN INSURANCE GENERALLY MORE THAN PAYS THE INTEREST ON THE COST OF THE WORKS.

The peculiarities of location, sources of supply, population and business pursuits of a community, all influence the characteristics of a water supply, and should receive careful and thorough investigation; but there are certain considerations of a general character which are deemed worthy of attention.

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The first and most important of these, and the one which should receive more attentive examination than is usually bestowed upon it, is the

QUALITY OF WATER SUPPLIED.

Upon this depends the public health, and after thorough research it has been definitely established, that THE QUALITY OF WATER FURNISHED TO A COMMUNITY HAS A DIRECT AND PROMINENT RELATION TO THE DEATH RATE.

It is seldom possible to find the water of any considerable stream as objectionable for drinking and culinary purposes as that procured from many of the shallow wells of old, and closely built towns. Water from these wells may appear to contain nothing objectionable either to the sight or taste, and yet carry in suspension or solution matter, which could we see or taste, nothing would induce us to use it. It is therefore generally found that the waters of a large stream, if there is a suitable one near, or of smaller ones if free from contaminating influences, are the most desirable for a town supply.

It is sometimes found advantageous to sink a large well, or to collect flowing springs, and there are instances where a copious supply of unobjectionable water is obtained for a community from a single spring or from an artesian well.

The consideration next in importance to quality is the

QUANTITY OF WATER PROCURABLE.

And this should have great influence in determining the source of supply. It should be such as would be sufficient for future demands as well as present ones.

The quantity to be furnished should be generous and ample, and as great as is possible without making the works burdensome in their erection. Many of our prominent cities and towns are greatly restricted in the use of this important element, and often destructive fires and pestilential fevers in them, can be traced directly to an insufficiency of pressure and volume to quench fires, and a deficiency of quantity to clear the gutters and sewers from filth and decomposing matter.

GRAVITATION WORKS.

Where a supply of good water can be secured from a source sufficiently elevated to distribute the water at a satisfactory pressure to the various parts of a town, it is the most advantageous method; for although the first cost may be greater, the expenses of maintainance are much lighter. The annual expenditures upon the care and repair of machinery, and the fuel required to propel it, represent the interest on a considerable outlay.

PUMPING MACHINERY.

Where artificial means are necessary to obtain the requisite pressure, the apparatus employed should be simple and substantial. *A multiplicity of moving parts not only consumes power, but adds largely to the probabilities of accident.* The strength of ALL the parts should be ample for the maximum work which will be required of the machinery.

A very important item too often overlooked in the selection of pumping machinery, is its ECONOMIC OPERATION. Even for small towns this is worthy of careful consideration; for it is undoubtedly cheaper to pay well for an apparatus which will do more work with a given amount of fuel, or of water power, than to purchase on account of its cheapness a machine which is incapable of economic operation.

RESERVOIRS.

One of the most valuable adjuncts of a water supply, is a reservoir of some kind; the greater its capacity, and the more permanent its construction the better.

In a reservoir, much of the objectionable matter held in suspension in the water is deposited by subsidence, and the action of light and air dissipate much of the matter held in solution.

STAND-PIPES AND WATER TOWERS.

Where the erection of a reservoir of suitable size and depth, and at a proper elevation, is impossible by reason of the topographical features of a locality, WATER TOWERS AND STAND PIPES are adopted as the best substitute; *they are inferior to a reservoir in direct ratio to their respective capacities.* Stand-pipes are also used to great advantage in connection with a reservoir, when the latter is a long distance from the pumping station. By erecting a stand-pipe near to the pumping machinery, it receives all the shocks or waves there formed, and allows the water to flow more regularly through the pipes and relieves them from all recoil incident to the operation of the pumps.

DIRECT SUPPLY WORKS.

When Peter Morice introduced a direct pressure supply into the city of London in 1582, from the works which he constructed at the London Bridge, it was justly the wonder and admiration of the civilized world; and the ingenious Dutchman deserves great credit for his ability and progressive spirit.

But experience has demonstrated to London that notwithstanding the acknowledged value of these direct supply works a reserve amount of water for emergencies, such as temporary stoppage of the machinery, fire, or suddenly increased demand from any cause, is of great value; and that city now has connected with its water supply both reservoirs and stand-pipes.

Although direct supply works have been considerably introduced into our own country of late years, they have by no means fulfilled the expectation of those using them; for the slightest accident to the machinery places an entire community out of water, or a sudden demand so reduces the pressure from the works, as to make it useless just at the moment when most required. Were this class of works combined with a reserve as above described these objections would be overcome.

PIPES.

The sizes of all pipes laid should be ample for delivering the maximum amount required, and should be so proportioned as to perform their part in future enlargements and improvements. It is far better for a city to lay a few miles of pipe of ample size, than to put down double the amount of pipe, which in a few years must be removed on account of insufficient capacity. Six inch pipe is the smallest size recommended for street distribution, and on no account should any pipe less than four inches in diameter be laid for public uses.

Care in placing them sufficiently under ground to prevent freezing, and to lay them free from air traps is of great value.

VALVES AND HYDRANTS.

A liberal supply of stop-valves and fire hydrants should be made, the former to permit of the complete control of all parts of the distribution, the latter as a safeguard against disastrous conflagrations. The mechanism of the valves and hydrants should be simple and substantial; they should have brass valve seats, operating screws, nuts, etc.

The most expensive hydrants constructed, scarcely cost as much as one hundred feet of fire hose, and they last a life time, whereas the average *life* of hose is not over three years.

The economy of numerous fire hydrants is therefore evident. It is also advisable to have several hose connections to each hydrant, giving thereby facilities for concentrating a number of streams on a building with the minimum amount of hose. When these several connections are operated independently of each other the advantage is still greater, and the fire protection more complete.

Appreciating the difficulties experienced by the use of direct supply water works, and recognizing the value of some means of controlling and directing the operation of low service works, or those combining a series of services at various elevations, the following described apparatus has been designed and patented, and is in this manner brought to the attention of cities and towns which have to obtain all or a part of their supply by pumping.

THE IMPROVED FIRE PROTECTION

FOR CITIES AND TOWNS,

is the result of thirty years' experience in constructing and managing water works. The best Fire Protection is an adequate supply of water, accessible at all times in every part of a city or town, and the means of bringing the water to bear upon the building or material on fire. For effecting this, the most desirable arrangement is a reservoir containing a sufficient volume of water to meet any emergency, at such an elevation as will produce the necessary pressure to project the water upon the fire, with pipes laid through the various streets and the requisite fire hydrants, hose, etc.

It is not always possible, and sometimes it is not desirable, to have a pressure, adequate for fire protection from the reservoir, used for the ordinary supply of the town; and this apparatus is designed to permit the use of a reservoir, stand-pipe, or other receptacle for water, at such an elevation as may be practicable or desired, and at the same time possess the means of an ample fire protection. By reference to plates 1 and 3 the apparatus will be better understood.

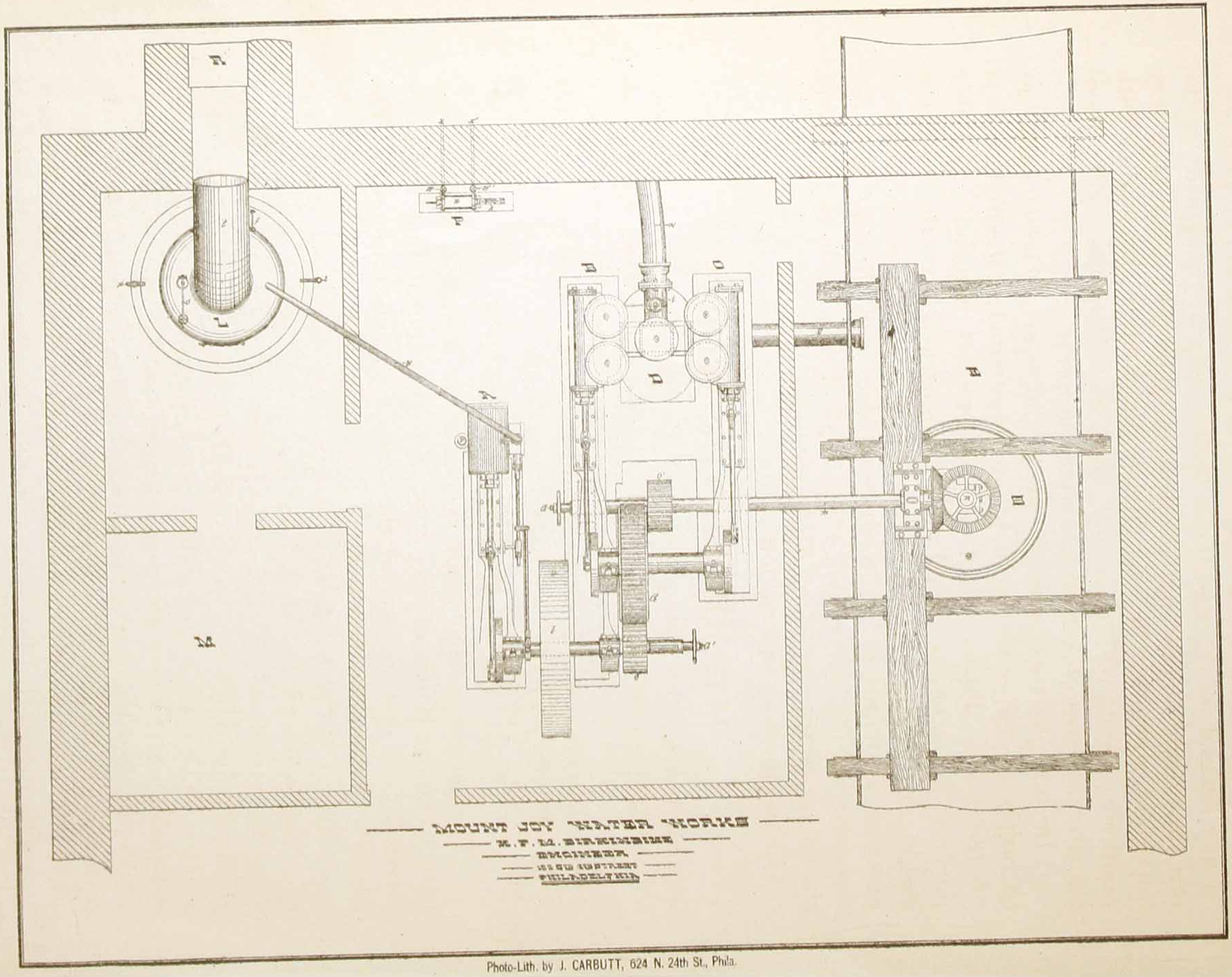
At any convenient point in the ascending main (that which carries the water from the pump to the reservoir) a branch is inserted, and a pipe laid to connect with the distributing main or mains (the pipe or pipes taking the water from the reservoir). Valves are placed in the pumping main and in this branch main, so arranged that they may be operated simultaneously; that is, one opened and the other closed, by means of a cylinder containing a piston operated by hydraulic or pneumatic power from the engine house, police station, or any desired point. The valves may be also operated by electricity if desired, but it is much more expensive.

A pipe is laid, and connected on each side of the valve in the main leading from the pump to the reservoir; this forms a by-pass, and is fitted with a safety valve, loaded to produce any desired pressure for fire purposes. Back pressure valves are also placed in the mains leading from the reservoir between the branch from the pumping main and the reservoir.

The operation of the apparatus is as follows: Immediately upon an alarm of fire, the position of the valves is so changed that the communication between the pumps and the reservoir is closed, and a communication opened between the pumps and the service mains leading the water from the reservoir to the town. This is performed from the pumping station, police station, or any other desired point, and requires but a moment of time. It is simply the turning of a small valve connected with the pneumatic compressor.

The pumping machinery will then become a Fire Engine, which can be immediately brought to bear upon a fire, wherever the mains are laid and means of attaching a hose provided. Should the steam be low, or from any reason the machinery not in a condition to supply the immediate demand made for the fire, the water will flow from the reservoir as in ordinary gravitation works. But as soon as the pressure produced by pumping becomes greater than that of the reservoir, the back pressure valve inserted in the supply main closes and prevents the water flowing into the reservoir.

The apparatus is also provided with a safety valve loaded, so arranged that when the pumps produce an excessive pressure which might rupture the pipes, this valve opens and allows the excess water to flow through the by-pass into the reservoir.



MOUNT JOY WATER WORKS

H. P. M. BIRKINBINE

ENGINEER

152 SO 4th STREET

PHILADELPHIA

Photo-Lith. by J. CARBUTT, 624 N. 24th St., Phila.

This arrangement will enable a town to have a fire protection of any desired volume and force, limited only by the power of the machinery and the strength and capacity of the pipes. One very important advantage is, that it can be used in connection with reservoir, stand-pipe, etc., and does not dispense with these valuable features of a complete water supply.

In some instances, the altitude of the reservoir is not sufficient to supply the upper stories of buildings situated in the higher parts of the town, during the times of greatest demand. For this purpose a tower or stand-pipe is constructed to the requisite height, and the water pumped into it during the day when increased pressure is required, or in time of fire, and directly into the reservoir during the night; the changes being made by operating the valves of the Improved Fire Protection.

The following description of the

MT. JOY WATER WORKS,

is presented to show the operation of this Improved Fire Protection, and to give an instance of a small and complete water works, constructed at so moderate a cost, that there is probably not a town of 2000 inhabitants which cannot afford to have a good water supply with complete and efficient FIRE PROTECTION.

PUMPING MACHINERY.

The pumping machinery is located in a grist-mill about one mile from the centre of the town, and so arranged that it may be driven by the water-power of the mill, or by a steam engine. The machinery is shown by drawing No. 2, representing a plan of the machinery. **E** is the flume which is also the wheel case. The effective head and fall is five feet six inches. **S** is a turbine wheel forty-three inches diameter; the power being conveyed to the pumps by the mitre gear and intermediate shaft *m*. **B** and **C** are the pumps. These are double-acting piston pumps with metallic valves and pistons, and have an air vessel placed over each pair of valves and a fifth one over the connecting pipe; this also contains check valves so that one of the pumps may be stopped without interfering with the other. The water is taken from the well **D** by the pumps. This well is supplied from the flume through the pipe *g*, or when the flume is empty from the tail race through a lower pipe. **A** is the steam-engine, the fly wheel of which is turned off as a band wheel so that the engine may be used to propel the mill in time of low water when not employed in pumping.

The pumps are represented by the drawing, as being propelled by the steam-engine. To change from steam to water power it is only necessary to draw out the pinion *c* by the hand wheel *a*', and draw the pinion *c*' into gear by the hand wheel *a*; these pinions slide upon feathers, and are operated by screws. The spur wheel *d*, on the pump crank-shaft, is a mortise wheel with hickory cogs. The machinery is made very strong and the wearing surfaces ample, so that it will run for many years. The upright tubular boiler **L**, generates steam in a short time and very rapidly; it is clothed with brick work and plastered to prevent loss of heat.

P is the apparatus for operating the valves of the fire protection, which are placed in the pumping main near the reservoir, 1500 feet distant from the pumping works.

RESERVOIR.

The reservoir is situated at an elevation of 126 feet above the mill dam, and 86 feet above the mean level of the town. It is constructed by excavation and embankment, lined with clay puddle and paved with brick on the inside. The ordinary depth of the water is twelve feet, at which depth it contains 500,000 gallons.

PIPE.

These are all of cast iron, full weights and tested to 300 pounds pressure to the square inch. The pumping main to the reservoir, and supply main from the reservoir to the centre of town are eight inches in diameter; from the eight-inch main six inch mains branch up and down the main street, from these four-inch pipes are laid. The total length of pipes laid is 18,500 feet.

FIRE HYDRANTS.

There are thirty hydrants located in different parts of the town, each one so arranged that three hose connections can be made and three separate and independent streams thrown at the same time.

OPERATION OF WORKS.

The town is ordinarily supplied by means of the water power. The works running at a fair working speed will pump 300,000 gallons of water per day into the reservoir, but in good stages of water 500,000 gallons can be pumped per day. With the steam engine the pumps can safely be run at such a speed as to pump at the rate of 700,000 gallons per day. The pump valves are furnished with *patent water cushions*, and can be worked to great speed without shock or noise, as the valves and seats never come into violent contact,

THE FIRE PROTECTION.

This is the novel and most distinctive feature of these works. The apparatus is shown in detail by drawing No. 3, Fig. 1, and consists of an air cylinder **C**, which cylinder operates two valves, shown in the section of the valve chamber **A**, by *o*; these valves are so arranged that the moving of the piston in the air cylinder **C** will close one and open the other. A safety valve **D** is placed in the by-pass. The valve is loaded by means of the weight *y* on the lever *p* to any desired pressure. Fig. 2 represents an ordinary check or back pressure valve, which is placed in the service main to the town, near the reservoir, and is kept open by the flow of the water from the reservoir; and closes whenever the pressure in this main, beyond the valve, becomes greater than that of the reservoir.

OPERATION.

By working the air pump in the engine room, see **P**, drawing Nos. 2 and 3, which is connected by means of the pipe *nn′* to the air cylinder, drawing No. 3, the valves are opened or closed, and the water turned off from the reservoir and admitted directly into the service main to the town, or by reversing the valves the water may be pumped into the reservoir, and the direct connection with the town shut off.

HOW USED IN TIME OF FIRE.

Whenever the engineer is notified of a fire, he immediately changes the valves, if pumping into the reservoir, so as to pump directly into the town; the power of the pumps is then brought to bear upon the fire hydrants; should the works be running by water power, the gate is raised to give all the power to the wheel. The fire is then lighted under the boiler, and before the dam could be drawn down, steam will be up, and the power may then be changed from water to steam, as described above.

Thus each fire hydrant becomes equal in power and efficiency to a first-class steam Fire Engine, with the advantage of being at the required place, without the necessity of dragging it there. Should the pumps not be in operation from any cause, *there will always be the reservoir pressure, and the water stored in it ready for use in any emergency*—thus insuring water for fire purposes, even should the pumps not be in operation. In the ordinary direct supply works, no water can be had in case of fire, unless the pumps are in operation.

The changing of valves to put the Fire Protection in or out of use is a matter requiring but a moment of time, and whenever the works are stopped the valves are arranged so as to pump directly into the town in case of emergency. The apparatus was since improved by substituting a compressor for the air pump, which is charged by the pressure of the water and requires merely the turning of a valve.

SAVING IN INSURANCE RATES.

By the introduction of this Improved Fire Protection, in connection with the water supply of Mount Joy, Pennsylvania, the insurance rates have been greatly reduced, as will be seen from the following instances:

1st. A frame dwelling in the heart of the town which formerly paid a premium of twenty-four dollars and fifty cents per annum, for an insurance on sixteen hundred dollars, now pays at the rate of ten dollars per annum on an insurance of two thousand dollars.

2d. The proprietors of a large tannery write as follows: "Insurance on our tannery and contents formerly, was four and three-quarters per cent., upon amount insured in first class companies; we now have three-year policies for all we wish to carry at two and a half per cent., A SAVING OF TWO AND A QUARTER PER CENT. On the dwellings in close proximity to the tannery, we paid formerly one and a half per cent., now we pay in one case, one per cent., and in others three-quarters of one per cent. The SAVING IN THE INSURANCE rates of our tannery and contents, PAYS ALL OUR STATE, COUNTY AND MUNICIPAL TAXES, and leaves a surplus of sixty-seven dollars and eleven cents ($67.11).

3d. A frame hotel had its rate reduced from two to one and a half per cent.

4th. In one instance a gentleman who uses the water throughout his dwelling, with baths, water closet, etc., saves in insurance rates more than sufficient to pay his taxes and water rent.

The above will demonstrate that a properly constructed water supply with a complete Fire Protection, will pay a community instead of being a burden.

№ 3

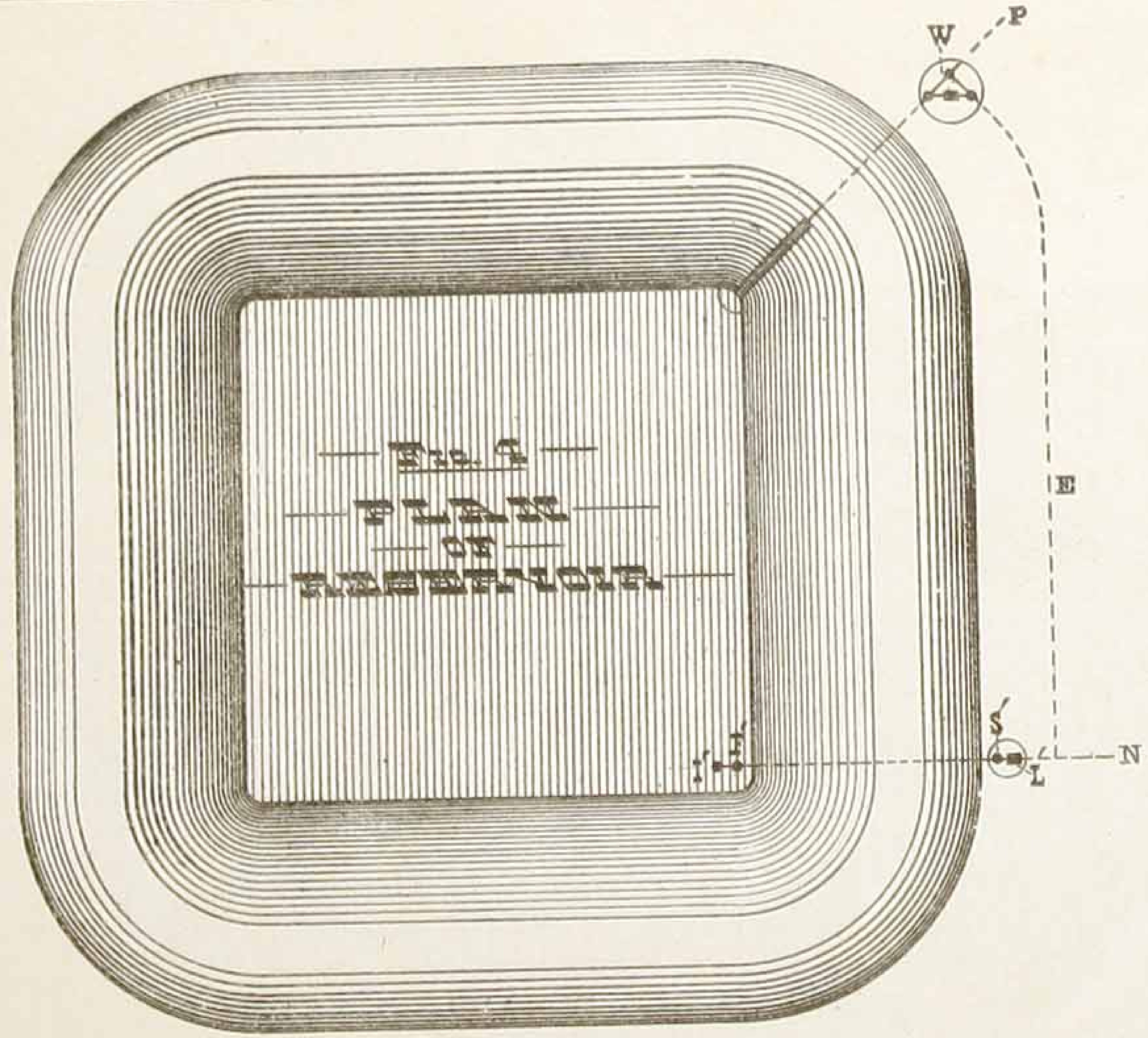


Fig. 4

PLAN OF RESERVOIR.

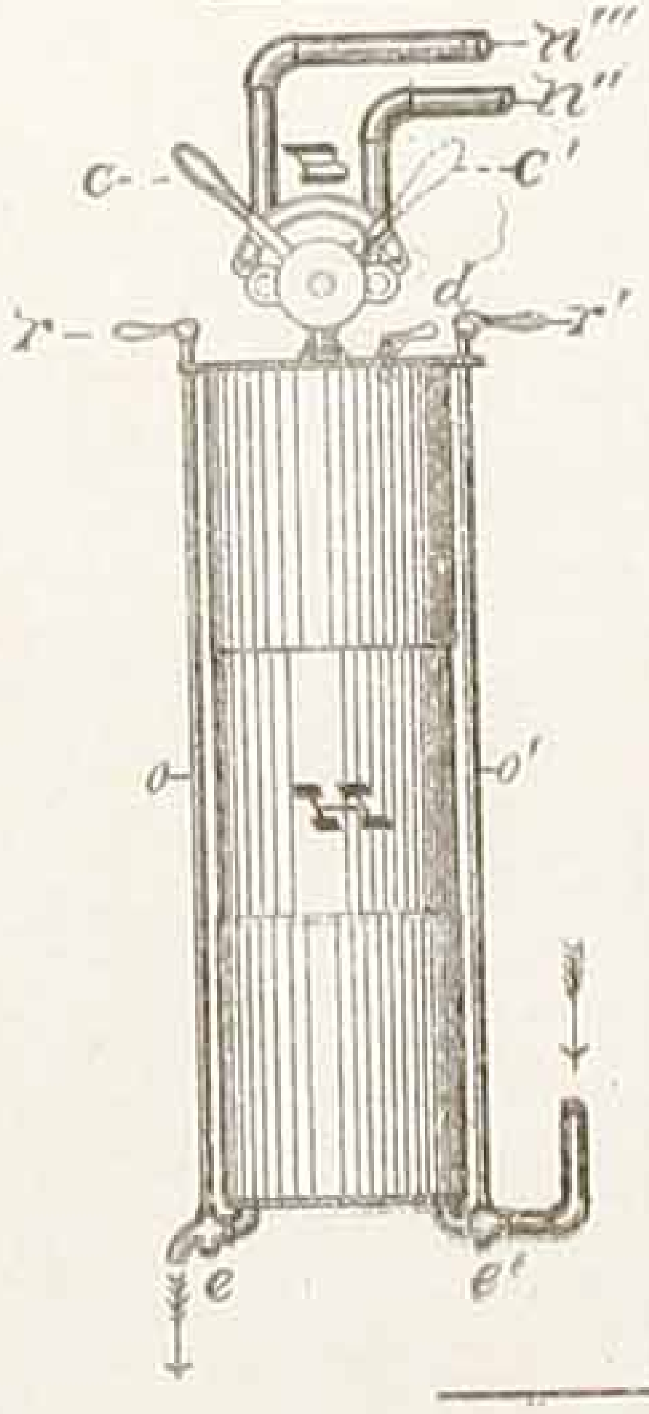


Fig. 3

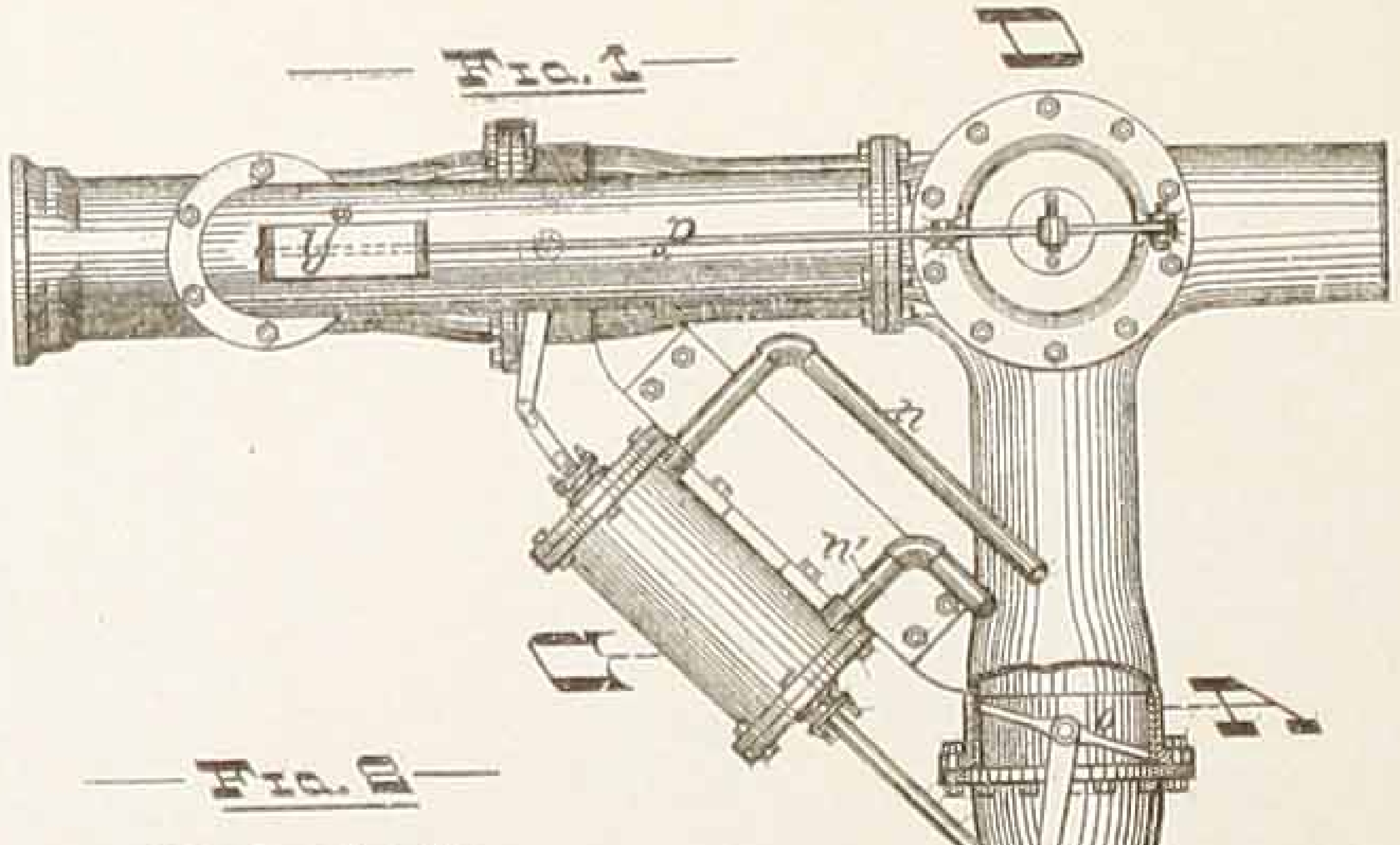


Fig. 1

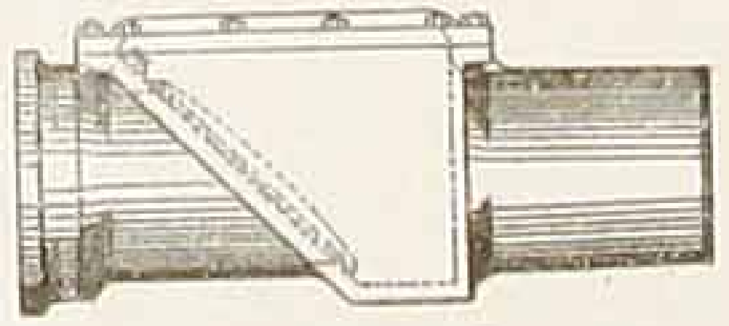


Fig. 2

IMPROVED FIRE PROTECTION

H. P. M. BIRKINBINE

ENGINEER

152 SOUTH FOURTH STREET

PHILADELPHIA

PATENTED { DEC. 31ST 1872 / JAN. 11TH 1878

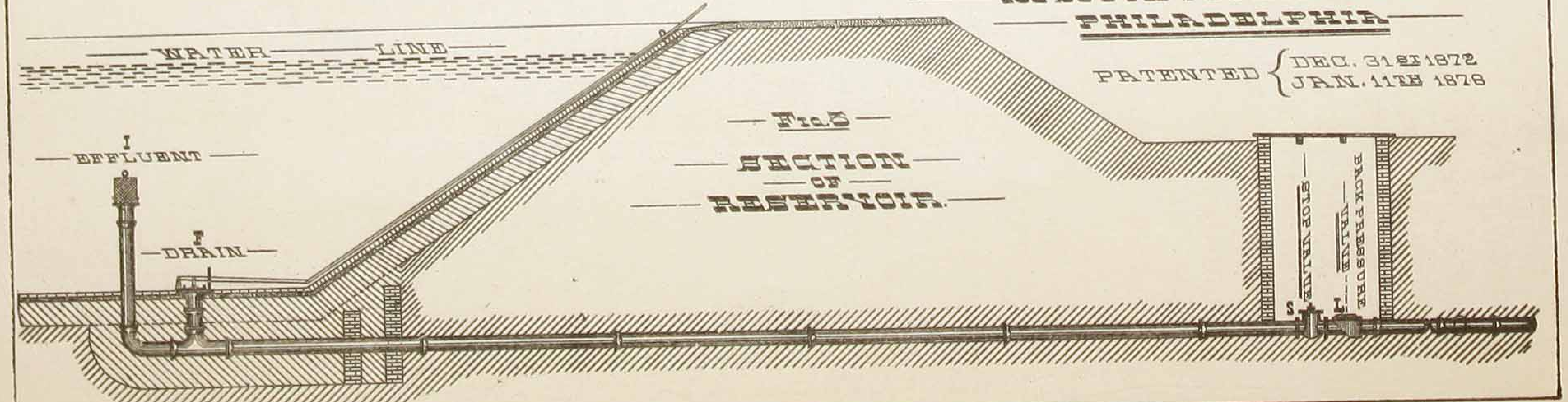


Fig. 5

SECTION OF RESERVOIR.

Photo-Lith. by J. CARBUTT, 624 N. 24th St., Phila.

DESCRIPTION OF ILLUSTRATIONS.

The cut on the next page represents the buildings of the Water Works for Erie City, Pennsylvania, in 1868; which were constructed under my supervision. They represent a stand-pipe used in connection with a reservoir. The water is taken from Lake Erie, 1100 feet from the shore, and pumped through a stand-pipe 230 feet high, into a reservoir two miles distant, having a storage capacity of 30,000,000 gallons.

The machinery consists of two Cornish Bull Steam Engines, each with a daily capacity of 2,000,000 gallons.

The steam cylinders are 60 inches diameter, the pumps 21½ inches diameter, and the stroke 10 feet.

PLATE 1 represents a town plan, showing the position of the Improved Fire Protection apparatus, etc.

PLATE 2 is a plan view of the Mount Joy pumping machinery described on pages 7 and 8.

PLATE 3. Fig. 4 is a plan of a reservoir, in which **P** is the pipe from the pump to the reservoir. **W** the apparatus for changing the valves; **E** is a pipe connecting the main from the pumps, with the pipe **N** leading from the reservoir to the town. **S′** is the stop valve, and **L′**, the back pressure valve in position. Fig. 5 is a section of a reservoir showing the ordinary method of constructing small reservoirs, and the arrangement of the pipe taking the water from it for the supply of the town. Fig. 3 is an apparatus for compressing the air, to operate the valves. This is placed in the pump room house, and is connected with the apparatus for changing the valves by the pipes $n'' \ n'''$. The valves are changed by simply moving the lever c to c'. Fig. 1 is the apparatus for operating the valves. C is the air cylinder connected with the compressor by the pipes $n \ n'$. Fig. 2 is the back pressure valve.

PLATE 4 is a view of the stand-pipe now being erected at Bloomington, Illinois, from plans prepared in this office. The tube is 8 feet in diameter, and 200 feet high.

The cut on the cover represents the stand-pipe which I erected for the West Philadelphia Water Works, in 1855.

These two illustrations exhibit views of enclosed and unenclosed stand-pipes.

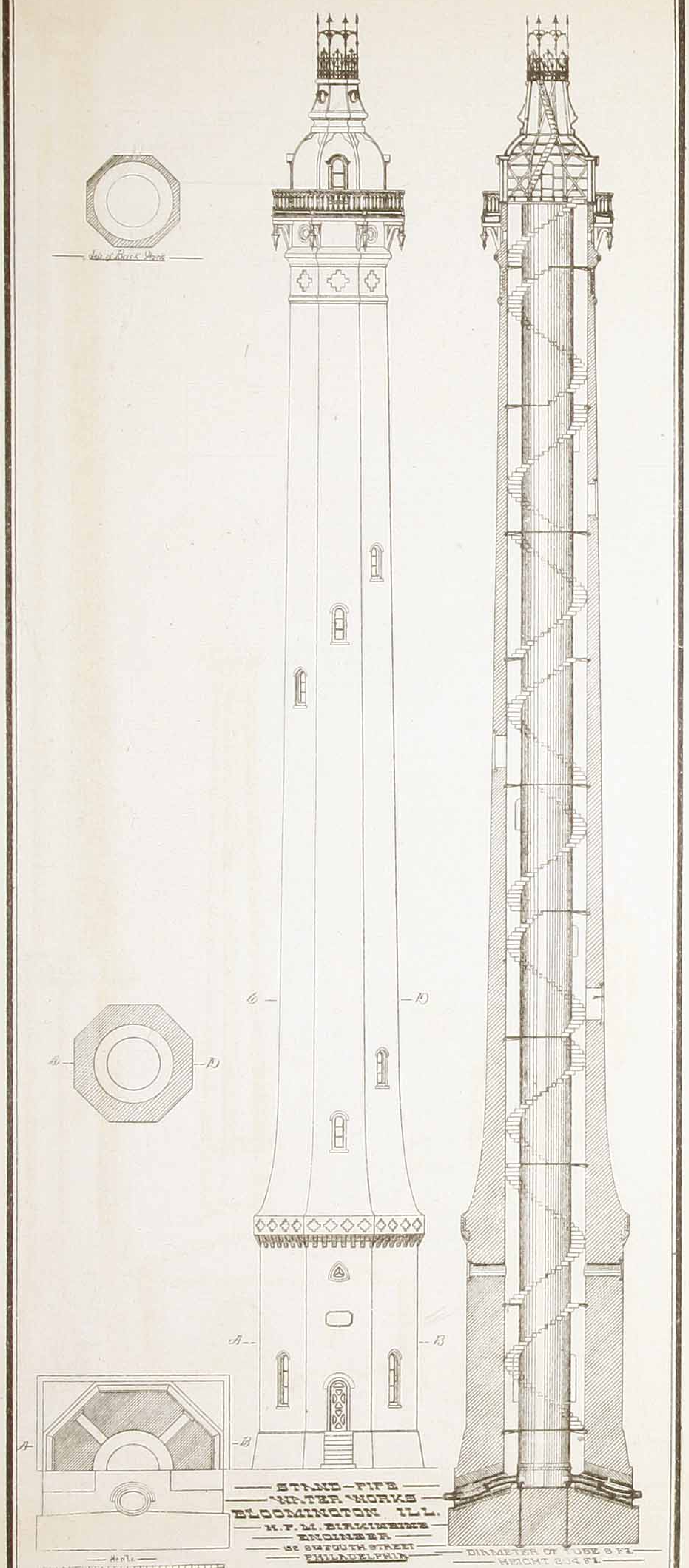


Photo-Lith. by J. CARBUTT, 624 N. 24th St., Phila.

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